ably boron carbide—is the preferred material for the hard facing tiles **5**. The hard facing layer **3** assists in blunting any sharp edges on fan blade fragments which could cut through the fibrous backing layer **4**, and also acts to distribute the fan blade impact over a larger area of the fibrous backing layer **4**. The hard facing tiles **5** are encapsulated on all sides by an elastomeric material **6** to isolate the ceramic tile material from one another so as to prevent propagation of impact damage from tiles in the path of a failed fan blade to tiles not directly impacted. This arrangement minimizes the size of the area damaged when a fan blade fragment impacts the containment system. The elastomeric material **6** is, preferably a castable, low-temperature curing, two component polyurethane such as PR-1592, but can also be any natural or synthetic elastomer. After the hard facing tiles **5** have been encapsulated by the elastomeric material **6**, they are bonded to the conventional metal fan blade case **2**. The bonding material can preferably be a low-temperature curing polyurethane elastomer such as PR-1592, but can include any natural or synthetic resin or elastomer.

FIGS. **3***a* and **3***b* show cross-sectional schematic representations of two of three alternative configurations of the fibrous backing layer **4** of the present invention. In FIG. **3***a*, the fibrous backing layer **4** uses continuous binder layers **7** interspersed between layers of fabric **8**. The fabric layers are preferably constructed of any high-strength, tough fiber, such as an aramid, but can also include polyethylene, nylon, glass or carbon. Kevlar 29, in a bi-directional woven fabric, is the preferred material for fabric layer **8**. The binder layers are preferably a polyurethane elastomer such as PR-1592, but can include any natural or synthetic resin or elastomer. As each fabric layer **8** is applied over the surface of the hard facing layer **3**, a thin film of a binder material is applied to the surface of the individual fabric layers **8**. The binder material is applied in a manner such that it remains on the surface of the individual fabric layers **8** and does not impregnate the fabric material. After the application of each of the fabric layers **8** is complete, the binder material is cured to form the binder layers **7**.

FIG. **3***b* shows an alternative configuration of the fibrous backing layer **4** which uses intermittent layers of binder **9**. The binder layers **9** are applied in discrete bands, squares or circles to allow better control of the amount of bonding achieved in the final product. As with the continuous binder layers **7**, a thin layer of binder is applied to surface of the individual fabric layers **8** so as not to impregnate the fabric material. After application of each of the fabric layers **8** is complete, the binder material is cured to form the binder layers **7**. A third approach to bonding the fabric layers **8** to the hard facing layer **3** is to impregnate the fabric layers **8** with a small amount of binder to form a porous low strength laminate. This process would be accomplished by impregnating the fabric layers **8** with a long shelf-life, low temperature curing bonding material, which fabric layers would later be wrapped over the hard facing layer **3** and cured to form a bond. The fabric layers **8** may be in any convenient form such as roving, fabric or felt, but is preferably constructed of a bi-directional woven fabric.

The fan blade containment system **1** of the present invention is manufactured according the following steps. First, the tiles **5** are provided, preferably tiles of a low density ceramic. Next, the tiles **5** are coated in an elastomeric material **6**, preferably a castable, low temperature curing polymer such as PR-1592. The coating step is preferably accomplished by placing the tiles in a closed mold—shaped to form either the entire array of the hard facing layer or a section of that layer—into which the elastomeric resin is injected. After the tiles **5** have been coated with the elastomeric material **6**, the elastomeric material is allowed to cure to form the elastomeric layer **6**.

Next, the coated tiles **5** are bonded to the metallic fan case **2**, preferably using a low curing temperature polymer such as PR-1592. After the bonding material is allowed to cure, the fan case **2** with coated tiles bonded thereto is overwrapped with the fibrous backing layer **4**. The fibrous backing layer **4** is wrapped over the hard facing layer **3** in one of three different ways. In the first method (represented by FIG. **3***a*), a thin film of binder **7**, preferably also a low curing temperature polymer such as PR-1592, is applied to the surface of each layer of fabric e such that it remains on the surface of the individual fabric layers **8** and does not impregnate the fabric material. The one or more layers **8**—depending upon the particular application—of the fabric material are then wrapped over the coated tiles **5** and the bonding material is then cured to form binder layers **7**.

In the second method of forming the backing layer 4, the fabric layer **8** the binder is applied in the same manner as in the first method, except that the fabric layers 8 are not completely coated with binder, but instead the binder is applied in discrete bands, squares or circles to form an intermittent binder layer **7**. The fabric layers 8 are then overlayed as in the first method, and cured.

The third method of forming the backing layer 4 entails impregnating the layers with a small amount of binder to form a porous low strength laminate. This method is accomplished by impregnating the fabric material with a long shelf life, low temperature curing, polymer, which is later cured after the wrapping step is completed. The resulting backing layer can take the form of that shown in either FIGS. **3***a* or **3***b*.

What is claimed is:

1. A method of forming a fan blade containment system for a turbofan engine comprising the steps of:

a. providing a fan blade case;

b. providing a plurality of hard facing tiles;

c. encapsulating said hard facing tiles in an elastomeric material to form fully coated hard facing tiles;

d. bonding said coated hard facing tiles to said fan blade case;

e. providing at least one layer of a fibrous backing material;

f. bonding said at least one layer of a fibrous backing material to said coated hard facing tiles.

2. The method of claim **1**, wherein:

said step of providing hard facing tiles comprises providing ceramic tiles.

3. The method of claim **1**, wherein:

said step of providing hard facing tiles comprises providing heat treated steel tiles.

4. The method of claim **1**, wherein:

said step of providing hard facing tiles comprises providing tiles constructed of boron carbide.

5. The method of claim **1**, wherein:

said step of providing at least one layer of a fibrous backing material comprises providing a layer of a bi-directional woven Kevlar.

6. The method of claim **1**, wherein:

said step of providing at least one layer of a fibrous backing material comprises providing a plurality of